How many legs does a dog have?" – Continuous online assessment in the Life Sciences

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ABSTRACT

It is becoming more commonplace in higher education for teaching, learning and assessment to be delivered in the online environment. There a variety of reasons for this, in part due to the numerous benefits afforded to both tutors and learners. This study explores the challenges faced by a group life science tutors at a UK university when implementing a continuous assessment strategy within an online environment. Adopting a phenomenological approach, interviews were conducted with nine tutors who have experience of implementing continuous and/or online assessments. Analysis indicates that there are several aspects that influence the delivery of continuous assessment in an online environment: 1) the purpose of assessment; 2) devising and managing assessment; 3) professional development; and 4) assessment in an online environment. For those adopting a continuous assessment approach in an online environment, it is crucial that tutors are aware of a range of assessment methods that help to promote self-regulated learning amongst students, through the delivery of personalised and detailed feedback in a timely manner.

KEYWORDS

Online assessment, continuous assessment, life sciences, higher education, phenomenology.

INTRODUCTION

The advent of online learning is having an impact on policy and practice in many universities around the world and is quickly becoming common place in higher education (Gikandi et al. 2011; Rowley et al. 1998). Larreamendy-Joerns & Leinhardt (2006) also note that teaching and learning in an online environment is now becoming more commonplace within an educator's everyday practices and in general, can be more advantageous than traditional instruction (Means et al. 2010). The use of online assessment presents an opportunity to enhance the learning environment for both tutors and students by addressing what the students are learning (Angelo & Cross 1993; Harris et al. 2007b; Whitelock & Brasher 2006), and encouraging them to take

responsibility for what they do (de Montes & Gonzales 2000). This has not gone unnoticed in the life sciences with many tutors using a variety of innovative methods to assess their students in the online environment (Harris et al. 2007a), including tests, quizzes and asynchronous discussion forums. By doing this, students have the opportunity to continuously test what they know and in most instances, get instant feedback on their work which can be used to guide their future learning.

This shift in delivering teaching, learning and assessment to an online environment is described by Norton and Wiburg (2003) as a 'defining technology'; one which causes a fundamental change in regards to how we see ourselves and the world around us. The socio-cultural implications of this on teaching and learning mean that educators need to consider how they can deliver a meaningful learning experience to students who live in an ever changing technological landscape. The shift from a traditional 'print' learning environment to one where online resources are, almost, expected by the students requires that the pedagogy of teaching, learning and assessment be reconsidered for the online environment.

As a next step to informing future teaching practice, this study focuses on the 'shift' to online assessment and was guided by the following research questions:

RQ1: According to life science tutors at a UK university, what are the challenges in implementing a continuous assessment strategy within an online environment?

RQ2: How can a continuous assessment strategy be effectively delivered in an online environment?

The research questions will be addressed by first exploring the role and importance of assessment in the Life Sciences, the relationship between assessment and learning, and the nature of online assessment. It then moves to explore the perceptions of tutors regarding the issues in implementing a continuous assessment strategy in an online environment. Finally, the focus is shifted to how an effective continuous online assessment strategy can be devised, considering the resulting impact on teaching and learning.

LITERATURE REVIEW

There is a plethora of research highlighting the importance of assessment within higher education (HE) and the integral part it plays in the student experience (Adams & McNab 2012; Biggs 2003; Bloxham & Boyd 2007; Brown & Knight 1994; Bryan & Clegg 2006; Nicol 2009; Ramsden 2003). Many of the assessment methods in the life sciences directly reflect disciplinary practice (Harris et al. 2007a) and although research projects, presentations and practical sessions form the core of a life sciences assessment strategy, alternative methods such as collaborative learning and self/peer-assessment are becoming more common (Nagel et al. 2005; Orsmond & Merry 2013). Exams and essays are also popular, with the multiple-choice question (MCQ) format being the method of choice for assessing many undergraduate degrees, especially in modules that have large numbers of students enrolled in them (Bond et al. 2013; Wood 2003)

and the ability to address the learning outcomes of a whole course (Bloxham & Boyd 2007). Discussion forums are becoming more popular (Cann et al. 2006; Gunn 2006; Harris et al. 2007a; Smith et al. 2005), but whilst many tutors are sceptical about their use in teaching and assessment (Brookfield & Preskill 2005), they are a valuable tool for revealing a learner's "diverse and complex views about a topic" (Parisio 2011, p.990).

Role of Continuous Assessment

Tutors also recognise the importance that the assessment process plays in the learning experience and the literature is littered with examples of 'good practice' (c.f. Chickering & Gamson 1987; Gibbs & Simpson 2004; Nicol 2009). Yet in the United Kingdom (UK), results from the National Student Survey (NSS) consistently show that the lowest level of student satisfaction is reserved for the assessment and feedback practices that they are exposed to (Beaumont et al. 2011; Nicol 2009; Williams & Kane 2009). There have been many suggestions as to what contributes to poor assessment and feedback practices, with perhaps the differentiation, and balance, 'formative' and 'summative' assessment being at the heart of this (Bloxham & Boyd 2007; Brown et al. 1997; Knight & Yorke 2003). Continuous assessment (CA) practices typically exemplify both formative and summative functions and thus offer an opportunity to support student learning and improve student performance. By assessing students continuously, they are encouraged to learn on a regular basis and have the opportunity to receive feedback on their work (Isakkson 2007; Trotter 2006).

It is paramount, however, to find a suitable balance between the amount of formative and summative assessment, since a focus on one type of assessment may have an adverse effect on the other (QAA, 2007). Extensive use of CA with a summative focus may impede the provision of good quality feedback and impact on a student's learning (Gibbs 2006; McDowell et al. 2007), whilst too much formative assessment may encourage students to only focus on those assignments which carry marks (QAA, 2007). There is also the issue of an increased workload for tutors, who need to closely monitor students and provide effective feedback, and for students, who need to consciously assess their own work (Le Grange & Reddy 1998; Yorke 2003).

Online Assessment

There has been increase in the use of computer-based/online assessment by tutors, allowing students to self-assess, get instant feedback on learning that they have undertaken and help improve performance in terminal assessments (Bax et al. 2006; Beebe et al. 2010; Buckely & Quellmalz 2013; Gikandi et al. 2011; Pitt & Gunn 2004; Ricketts & Wilks 2002). Many studies have reported on the positive effect of delivering formative/summative assessment through an online environment (Buchanan 2000; Marriott 2009; Scott et al. 2008) and this is also evident within the life sciences (Brewer 2004; Peat & Franklin 2002; Peat et al. 2004; Voelkel 2013). There does, however, appear to be a much stronger focus on the use of summative assessment when delivering learning online, with formative assessment given less attention (Pachler et al. 2010; Wang et al. 2008).

Maintaining continuous assessment activities demands large amounts of time from educators, not least because of the need to provide useful and timely feedback for students (Lin & Lai 2013; Wang 2007). Harris et al. (2007b) suggest that the use of online assessment with life science subjects offers the opportunity create self-paced assessment tasks and provide personal learning experiences, with Gunn (2006) suggesting that "the potential for online assessment to contribute a desirable shift from teacher to student centred learning is high" (p.255). By developing innovative assessment practices such as this, tutors can help to increase student engagement and motivation, whilst also helping them to become more responsible for, and reflect back on, their own learning (Bostock 2004; Lewis & Sewell 2007; McLoughlin & Luca 2002; Wong et al. 2001).

But as the role of the student becomes more self-regulated, it is also important that educators realise that their own role and assessment practices should also evolve to meet the challenges of online learning and assessment (Beebe et al. 2010) and perhaps not consider the same 'old' assessment methods. Gikandi, Morrow and Davis' (2011) comprehensive review online formative assessment in higher education suggests that whilst online assessment has the potential to engage students and teachers in a "meaningful educational experience" (p.2347), tutors need to consider the fundamental issues of validity, reliability and dishonesty that come with it. Reeves (2000) adds to this, explaining that the lack of visual cues, use of asynchronous conversations and technology issues mean that online assessment cannot be conducted in the same way as traditional, face-to-face assessment. Despite this, Qing and Akins (2005) argue that tutors should use they know about teaching in face-to-face environments to help inform online pedagogy. Consequently, there is a need to examine tutor attitudes in relation to assessment practices within an online environment and the challenges that they face.

METHODOLOGY

Phenomenology is a research approach that seeks to understand and articulate an individual's experiences through the process of reflection, by exploring the structures of consciousness in the lived human experience (Cresswell 1998; Giorgi 2005; Hsieh 2010; van Manen 1990; Patton 2002). Such experiences typify an individual's construction of a particular phenomenon, highlighting the essence of it within a particular context (Heidegger 1988; Jonassen et al. 1994) since we can only really know the world we are in as we consciously experience it (Husserl 1913). Adopting a non-dualist, second order ontological approach (Trigwell 2006) to this study, empirical phenomenology affords the opportunity to focus on the phenomenon by accessing the re-lived experiences of participants in relation to a phenomenon and focus in on the commonalities.

Research Design

Ethical approval for this study was successfully obtained before potential participants were recruited. To investigate RQ1, an email invitation describing the purpose of the study and the research procedures to be followed was then sent to 30 tutors who taught

with the Life Sciences department. All tutors emailed had some experience of continuous assessment and/or implementing assessments in an online environment and thus, were selected based on their appropriateness and relevance to this study (Englander 2012; Speziale & Carpenter 2007). Of the 30 potential participants, nine (38%) responded positively and indicated a willingness to take part in the study and their details are highlighted in Table 1. The sample size (n=9) for this study meets the recommended expectations for empirical phenomenology research (Englander 2012; Giorgi 1997), since the focus is to seek the meaning of the phenomenon, rather than how many people have experienced it.

Table 1: Participant Characteristics (Teaching experience is in years; names are pseudonyms)

Name	Role	Gender	Teaching Experience
Andrew	Senior Lecturer	Male	25 +
Cheryl	Senior Lecturer	Female	10 – 15
David	Senior Lecturer	Male	15 – 20
James	Reader	Male	20 – 25
Jill	Lecturer	Female	< 5
Lindsey	Lecturer	Female	< 5
Paul	Professor	Male	25 +
Steve	Senior Lecturer	Male	20 - 25
Susan	Senior Lecturer	Female	25 +

Data Collection and Analysis

One of the most important aspects of empirical phenomenology is for the researcher to be sensitive to an individual's conceptions of the world, by 'bracketing' their own assumptions; putting to one side their own preconceived ideas about the phenomenon in question and focusing on how it appears to the participants (Giorgi 1997; Oberg & Bell 2012; Wilson 2002). To aid with this, the preferred method of in-depth, semi-structured interviews were utilised (Ashworth 2003; Kvale 1996; Penner & McClement 2008). A small number of open-ended, entry questions were derived and pilot tested with a participant who was not involved in the subsequent data gathering. Where necessary, questions were revised before the interviews began.

Interviews were conducted face-to-face, lasted between 40-60 minutes and were recorded and transcribed verbatim by the author. At the beginning of each interview, the participants acknowledged that they understood their rights in taking part in the study and gave permission to use the data collected. A journal was also used throughout the interviews to make notes and help signpost further questions. To respect participant privacy and confidentiality, access to the recordings and transcripts was limited to me only and measures were taken to ensure the anonymity of all data.

To investigate RQ2, analysis of the data relied on the 'constant comparative method' (Glaser 1978), using both 'substantive' and 'theoretical' coding to ensure that any resultant theory is grounded in the data. Using NVivo 10 software, the interview transcripts were analysed individually, line by line using open codes to code the data in as many ways as possible. Given that there is no framework to follow in this process, a recursive approach was adopted to constantly compare the codes with the data until

categories started to emerge. For the final step, theoretical coding is the process of conceptualising "how the substantive codes may relate to each other" (Glaser 1978, p.72). During this stage, the theoretical codes emerge from the data with Glaser providing over 18 coding 'families' to help "weave the fractured story back together" (Glaser 1978, p.72) resulting in the final grouping of codes, or themes. The analysis of the transcripts identified a number of areas of that tutors identified as challenging, with similar challenges grouped together into overarching themes. Representative quotations have been utilised to help illustrate each of the theme

CONTINOUS ONLINE ASSESSMENT: THE TUTOR VIEW

Analysis of the data indicates four key areas that tutors should consider when implementing a continuous assessment strategy in an online environment.

Purpose of Continuous Assessment

The tutors tended to describe the purpose of continuous assessment as an opportunity for students to complete a formative task and get feedback on their learning. This feedback would then be used when completing a summative task, which would either take place within a few weeks of completing the formative assessment, or typically at the end of the module in the terminal assessment.

> *"You might have practice things, which lead into summative. We do that in MOD100[1]; in the second semester, they get three weeks of writing an abstract for experimental design. They have to do it […] and they write it in their lab book and hand it in [and] get feedback for how to improve it." (Jill)*

> *"Students in the past see the lectures as a performance and they don't know what they are supposed to take from them […] I think the formative and summative assessments will hopefully get rid of that […] and these students will know what they are supposed to get out of it." (Paul)*

Devising/Managing Assessments

The tutors described the process of assessment as one which was time consuming and problematic. The participants collectively focused on a limited number of assessment methods that they believed were appropriate for the online environment, including MCQ tests, short answer questions, and essays. This was in part due to the large numbers of students that they have on their modules and this does appear to place a restriction on the assessment methods that they are willing to use:

> *"The thought of doing any marking that is not in the exam period sends shivers down people's spines. It's not as awful as it sounds, as people have grant deadlines and they come in the middle of a semester. It's not just laziness which made us do this [the terminal exam]." (James)*

[1] Module code changed for anonymity purposes

When asked to consider alternative assessment methods, such as discussions or group work, the opinion was split. Whilst some felt that the use of these assessment methods would be extremely useful, others were concerned about how these could be objectively assessed or the validity of the assessment:

> *"We've also tried discussions but it is extremely difficult […] they are reluctant to come forward [and] it becomes really complicated in how do you judge a discussion contribution; is it the quality or the quantity? (Lindsey)*

Professional Development

Closely linked to the previous two themes, nearly all of the participants expressed the need and want for staff training with regards to assessment methods and/or the use of technology. Several of the participants were unwavering in their opinion that staff should be engaged in pedagogical research, in addition to their own subject research. For many staff though, pedagogic research falls outside of their 'comfort zone' and James makes an interesting remark:

> *"We have no culture which forces people to engage. I'm not saying assessment here is bad, but it can be localised and influenced by 'corridor mythology' […] and staff need up to date information on how you can set objective tests and see how they achieve different things [because] everyone has done the simple 'how many legs has a dog' multiple choice questions, but not everyone here in my estimation has done much more complex demanding questions."*

But staff development is not just limited to pedagogical aspects; the increased use of technology in the delivery of teaching and learning has left many academics relying on other colleagues to provide support:

> *"[For the] setting of the assessments, I've got to learn how to do it [because] I'm letting somebody else figure that out and hold my hand through it." (Steve)*

> *"From a staff viewpoint, [we need] training to set up the tests, making sure all the boxes are correct and feedback is given back at the right time. I think we also need some guidelines so that everyone does it consistently." (Lindsey)*

Assessment in an Online Environment

There was some concern amongst the participants regarding the use and integrity of online assessment, and the challenges associated with the online medium. Many expressed a concern that in adopting online assessment, there may be a tendency to only use automated testing:

> *"We can't go all the way to using online forms of assessment because there are certain things that the students need to go away, research, and write about them and express their opinions or provide evidence for stuff. That's a key part of*

being a scientist, so there's no way we are going to move away from that." (Andrew)

As we have already seen, there appears to be a particular focus on the use of MCQ tests and examinations within the life sciences, mainly due to the large numbers of students and the minimal amount of time in which to grade work and provide meaningful feedback. Upon closer inspection, it appears that the use of particular assessment methods might be an attempt to ensure the integrity of the assessment process, something which may be at risk in online environment:

"The obvious problem with online assessment is you can never test to see if the individual did the work […] or the extent to which they contributed to the work, unless there's some magic way that I don't know of. There's no way that you can't tell that two people sat down and discussed or someone gave somebody else all the answers." (Steve)

The use of an online medium to deliver assessment also presents a number of accessibility issues and these were particularly pertinent with the participants. By providing facilities for the students to complete assessments online, they could make allowances for any problems that occurred. However, even if students are provided with the facilities within the university to complete such assessments, it does not get away from the issue of reliability:

"My experience of VITAL (university VLE) is if you set assessments that were under time constraints for example, it can lead to terrible problems […] it freezes, it collapses, the pictures are not there […] the system is just too sensitive and if the test breaks, the whole system breaks. If you don't have a plan B, i.e. you haven't printed it out, you're doomed!" (Cheryl)

DISCUSSION

Limitations

The issues of sample size and quality in qualitative research are widely discussed in the literature and are notable areas of debate (c.f. Caelli et al. 2003; Tracy 2010). When considering the number of participants, some may well consider the sample size to be too small to draw any meaningful conclusions. However, the use of small sample sizes in qualitative research is not uncommon, particularly when there is a focus on the individual and their experiences (Cresswell 1998; Crouch & McKenzie 2006; Morse 1998), as is the case with this study.

It is also feasible that additional participants may have provided differing viewpoints to support, or contradict, the views presented here. However, the time constraints enforced on this study made it difficult to access participants from further afield. As a result, the findings presented in this study are context specific to the participants, institution and researcher involved.

Reviewing the themes

Feedback plays an important role within the assessment process and it is important for bath staff and students to engage. Through continuous assessment, this is a realistic opportunity. Students are not only encouraged to engage with course material on a regular basis, but they can also receive feedback that is timely, and related to work that they have been doing. The added benefit is access to in course feedback with a view to ‘actioning’ what they need improve on later on in the course, rather than waiting till the start of the next.

Students should be exposed to a range of assessment methods across their studies, affording them the opportunity to express their knowledge and critical thinking skills in the most effective way. There is a potential over-reliance of assessment methods in many subject areas, and this is notable in the life sciences. Whilst the extensive use of MCQs might well be for good reason, students can be hindered in their learning and may become 'bored' and disengaged with the assessment process. Even more worrying, tutors need to consider the levels in which assessment methods are used; the use of MCQs in final year assessment for example can be considered to be inappropriate.

Assessment strategies are often rooted in 'historical practices', with many adopting approaches that are already used widely in a department, or are representative of the subject discipline. Encouraging tutors to actively engage in continuing professional development (CPD) and become more familiar with pedagogical research is a difficult task. Whilst the opportunity to help inform their research-led teaching is an obvious benefit, there are often conflicting priorities at play with pedagogical research falling not only outside of many tutors' 'comfort zone', but also outside of their remit.

When considering how assessments are devised with a department, the tutors in this study were very clear that guidelines need to be put in place which dictate' the development of assessments. This would direct them in the format of particular types of assessment, the levels at which they can be appropriately used, timings, number of questions, fall backs, etc. and would also promote a consistent approach. From here, the development of an assessment strategy for a module could be carried out by a module team who will all be working within the same parameters.

As many universities are now beginning to embrace, and integrate, technology within teaching and learning, such guidelines should also give consideration to the nature of assessment in an online environment and the additional challenges it brings. Issues of integrity, validity and dishonesty all take on new meanings in the online environment and it is important that tutors are aware of them when devising an effective assessment strategy. Whilst the use of an online MCQ test may provide an efficient way to test large groups of students, it may not prove to be a 'valid' method of assessment. Likewise, there is a need to ensure that assessments which are delivered online are reliable because of the volatile and somewhat unpredictable nature of technology.

'Effective' continuous online assessment

There is a strong impetus on tutors to use a variety of instructional and assessment methods to maximise a student's learning experience. This also includes the use of relevant technologies since many students, and tutors, have grown up as part of the 'digital-divide' (Prensky 2001) and have a "natural affinity with technology" (Waycott et al. 2010, p.1202). However, the factors affecting effective online assessment practices are not solely technology related (Beebe et al. 2010). At the heart of any learning environment lie the pedagogical issues of assessment validity, reliability and dishonesty, and these present themselves in new ways in an online environment (Oosterhof et al. 2008). Careful consideration of these is therefore needed in the formulation of a continuous assessment strategy.

Gikandi et al. (2011) argue that in the online environment, validity refers to the "degree in which the assessment activities and processes promote further learning" (p.2338). In the life sciences, students rarely face long examinations or MCQ tests once they have finished their degree so why do we expose them to these methods? By providing authentic assessment experiences for the students and exposing them to methods of assessment that they are likely to face later in life gives them the opportunity to apply what they have learned in simulated situations and is absolutely crucial. Crisp and Ward (2008) support this, arguing that providing learners with an opportunity to demonstrate 'metacognitive thinking' promotes validity, whereby learners are exposed to real world problems that allow them to utilise knowledge they have already acquired.

Supplementary to this is the effective use of feedback, which as mentioned by one of the participants should be timely, personal and detailed (Koh 2008; Wang et al. 2008). A review of online courses by Tallent-Runnels, Thomas, Lan, et al. (2006) stresses the importance of timely feedback in asynchronous learning environments to help sustain student engagement. Many online assessment systems, such as the one used by the participants in this study, offer the ability to provide automated marking and immediate feedback to students. In addition, the way in which feedback is presented to students also influences how much it is used (der Pol et al. 2008). The more the feedback relates to the student and the task at hand, the more useful they are likely to perceive it and take it on board.

The issue of assessment dishonesty was prevalent amongst the participants, with the main focus on ensuring that the ownership of work can be attributed to a particular learner, as well as ensuring they are using any resources within the stipulated boundaries (Khare & Lam 2008). Oosterhof et al. (2008) suggest that when the purpose of assessment is explained to the students, along with how they can achieve particular marks, then academic dishonesty is greatly minimised. This is supported by Kirkwood and Price (2008), who observed that a student's approach to learning can be influenced by the teaching and assessment practices utilised by educators. This clearly puts the onus on academics to promote a positive attitude towards learning and assessment to discourage surface learning approaches (Oosterhof et al. 2008) and promote authentic assessment activities.

Considering we are in the midst of a rapidly changing technological era, it is even more important that tutors keep up-to-date with technologies that can aid them in the delivery and assessment of their material. The online environment provides a useful vehicle in helping students to become more responsible for their own learning and it is becoming more commonplace to see constructivist approaches to teaching and learning in the online arena, which demand students to be self-directed and critical in their thinking (Oncu & Cakir 2011). The goal of encouraging self-directed learning demands that control be devolved to the learner and many educators are unwilling to do this, perhaps in fear of losing complete control. This is not necessarily a bad thing and the flexibility in online assessment methods means that students can decide when, where and how they want to engage with assessment and, by proxy, their learning (McKenna 2001).

But too often, the assessment methods used in the traditional, face-to-face learning environment are transposed into the online environment without a second thought with regards to their suitability. Beebe, Vonderwall and Boboc (2010) suggest that as technologies continue to evolve, it is important that we consider a pedagogical framework that encompasses the differences between the traditional and online learning environments, with regards to the delivery and mediation of teaching and learning. This requires 'buy-in' from tutors by providing, and possibly incentivising them, with opportunities to undertake both pedagogical and technological professional development. Hiltz, Kim and Shea (2007) believe that the lack of adequate support is one of the major factors in the dissatisfaction amongst academics for engaging in online teaching and learning and several studies have highlighted strategies which can be used to help support the development of educators in the online environment (Fredericksen et al. 2000; Howell et al. 2004). To motivate the shift from a tutor-dominated environment, a discussion around online pedagogy is needed which focuses on reconceptualising teaching and learning, and promoting constructivist interaction amongst the students (Boboc et al. 2006; Reeves 2000).

CONCLUSIONS

Regardless of the delivery platform, providing an authentic assessment experience for learners is paramount. Using assessment methods such as MCQ tests and the like, which benefit the tutor more than the learner, are counterproductive and will have a detrimental effect on all involved. Tutors should provide assessment methods that reflect the subject content, the associated professions and ultimately, provide an exceptional learning experience for their students. For tutors in the life sciences, online assessment provides an opportunity to do this, allowing students to become self-regulated learners and also give them access to automated feedback instantaneously.

These two points are even more pertinent when implementing a continuous assessment strategy, given the concerns for an increase workload for tutors to monitor students and provide effective feedback. For some, this requires engagement with professional development activities to help support the use of a wider range of range of assessments and the use of technology to derive and manage online assessments. Given the lack of empirical research in this area, the findings from this study provide a contribution to the knowledge on online assessment, by presenting the challenges faced by life science

tutors when implementing continuous assessment in an online environment. These challenges can also help inform the development and delivery of continuous online assessment, encouraging a consistent approach not only in the life sciences, but in other subject areas as well.

Future work would involve discussing the challenges of online assessment with a variety of life science tutors from other universities to see if the findings are still applicable, in addition to potentially uncovering other dimensions to the themes presented here. Triangulation of the data would also help explore whether the themes presented in this study are applicable to other subject areas within HE, aiding the development and refinement of a framework for delivering continuous assessment in an online environment.

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